

# Technical Update

## Environmentally Sensitive Areas: pH levels

### Purpose

This technical update provides general information related to determining whether or not a property is an environmentally sensitive area due to pH levels in soil, required by clause 41(1) (b) of Ontario Regulation 153/04. If a property is determined to be an environmentally sensitive area for this or any other reason, the standards in Table 1 of the Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act (March 9, 2004) apply.

It is important to note that this document does not deal with site-specific conditions and should not be used as a substitute for the exercise of professional judgment. It should also be noted that the description of the legislative and regulatory requirements given in this document are for convenience only. The relevant legislation and regulations, available at [www.e-laws.gov.on.ca](http://www.e-laws.gov.on.ca), should be reviewed to determine the exact requirements.

### Intent

Clause 41(1) (b) of Ontario Regulation 153/04 requires a “qualified person” to reach a conclusion about the pH value of the soil at the property.

This conclusion will determine whether or not the property will be identified as an environmentally sensitive area.

The requirements in clause 41(1) (b) ensure that the soil pH characteristics of a property are similar to those used in the development of the Ministry of the Environment’s generic standards. These generic standards are included in Tables 2, 3, 4 and 5 of Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act. If the characteristics are not similar, appropriate measures must be applied. Highly acidic or alkaline soil can cause contaminants to behave differently from the manner assumed in the generic models, making the generic standards inappropriate for use at a site with pH levels outside the acceptable pH range. The qualified person must undertake sufficient investigation to determine and characterize the pH values at the property, for surface and sub-surface soil.

It should be noted that the analytical protocol for pH set out in the ministry publication, Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, must be used in determining soil pH.

If appropriate sampling and analysis of all representative soils on a site yield no pH values that fall outside the acceptable pH range, section 41 of Ontario Regulation 153/04 does not apply. The acceptable pH range for surface soil is from 5.0 and 9.0. For subsurface soil, the acceptable range is from 5.0 to 11.0 .

If appropriate sampling and analysis of all representative soils on a site yield one or more pH value that falls outside the acceptable pH range, section 41 of Ontario Regulation 153/04 applies, and the Full Depth Background Site Condition Standards of Table 1 must be applied to the property.

Where a sampling round contains pH results outside the acceptable range at one or more points on the property, it is expected that appropriate characterization and delineation of pH values at the property will proceed, assuming that unacceptable values persist in the relevant surface or sub-surface soil from each unacceptable point to the next sample point on the property, in all directions, that falls within the acceptable pH range. Sampling sufficient to confirm or deny this assumption must be undertaken and adequate site characterization must be completed to delineate the extent of the area containing soil outside the acceptable pH range.

It should be noted that Ontario Regulation 153/04, subsection 48(2), permits the averaging of soil samples within a two-metre radius when determining applicable site condition standards. The ministry will accept the use of this averaging method in dealing with pH under section 41 of Ontario Regulation 153/04. Therefore, a single sample that falls outside of the acceptable pH range may not, alone, establish a property as an environmentally sensitive area. It is important to remember, however, that in allowing averaging, subsection 48(2) requires that the soils being averaged be collected from the same depths on or under the property.

If the correct averaging of discrete samples is not completed, the ministry will classify a site as an environmentally sensitive area on the basis of a single sample which falls outside of the acceptable pH range.

### **Mathematical Approaches to Averaging pH**

It is also important to note that certain mathematical approaches to averaging are not appropriate to make a determination under clause 41(1) (b). For example, since pH is based on a logarithmic scale, the use of arithmetic and geometric means is not appropriate. In order to average pH, a qualified person would first have to multiply each pH by -1, take the antilog of each of these values, add these values together, divide by the number of values and then, take the negative logarithm.

$$\text{pH} = -\log_{10}[\text{H}^+]$$

or

$$[\text{H}^+] = 10^{-\text{pH}} \text{ where } [\text{H}^+] \text{ is the hydrogen ion activity.}$$

For example:

$$\text{Discrete sample 1} = \text{pH } 7.0 = [\text{H}] \text{ of } 1.0 \times 10^{\text{-7}} \text{ or } 0.0000001$$

$$\text{Discrete sample 2} = \text{pH } 5.0 = [\text{H}] \text{ of } 1.0 \times 10^{\text{-5}} \text{ or } 0.00001$$

$$\text{Mean} = 0.0000101/2 = 0.00000505 = 1.0 \times 10^{\text{-5.297}}$$

$$\text{Mean pH} = 5.297 \text{ rounded to pH}=5.3$$

As stated above, the averaging of samples is only permitted within a two-metre radius and within the same unit or horizon. If the appropriate method for averaging is not used, the site will be deemed an environmentally sensitive area due to the presence of a single sample which falls outside the pH range.

### **Application**

A property owner has the following options when filing a Record of Site Condition for a property that has soil that does not fall within the acceptable pH range.

#### Option 1- Remediation

Neutralizing or removing the soil.

#### Option 2 - Risk Assessment

A risk assessment approved by the ministry's Director can provide for the application of risk-based or risk-managed site-specific standards. Any risk assessment submitted to the ministry for review should include a conceptual site model that clearly identifies areas where pH falls outside the acceptable range and overlay these areas with areas of contamination. A discussion of the effects of the pH levels on the contaminants of concern, established by screening against Table 1, and their associated risks should be included.

#### Option 3 - Two Records of Site Condition

Two Records of Site Condition can be filed for the property. The first Record of Site Condition

should apply Table 1 standards or property-specific standards as specified in an accepted risk assessment for the environmentally sensitive site, or the area where soil falls outside the acceptable pH range. The second Record of Site Condition should apply the generic site condition standards of Tables 2, 3, 4 or 5, or property specific standards as specified in an accepted risk assessment, to the remaining surveyed portion of the property. Both areas must be surveyed and a copy of the survey must be provided as supporting documentation for the Record of Site Condition (Ontario Regulation 153/04, Schedule A, section 5, subsection 7).

Additional ministry documents related to contaminated sites, including the Tables of Standards and Ontario Regulation 153/04 can be found at:

<http://www.ene.gov.on.ca/envision/land/decomm/condition.htm>

For further information contact your local district office at:

<http://www.ene.gov.on.ca/envision/org/op.htm#Reg/Dist>

